

The Flora and Fauna of a Basin in Central Florida Bay

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ABSTRACT

One hundred ninety-six species of plants and animals are reported from a nursery area for pink shrimp, Penaeus duorarum duorarum, in a basin of central Florida Bay. Many of the organisms are benthic and associated with shallow beds of turtle grass, Thalassia testudinum. Although abrupt habitat variations may affect species distribution, the general distribution of organisms in the basin and bay defines environments influenced by different water masses.

INTRODUCTION

Florida Bay is at the southern tip of the Florida peninsula. The bay serves as a nursery ground for pink shrimp, Penaeus duorarum duorarum, before they move to the Tortugas shrimping grounds, northwest of Key West (Costello and Allen, 1966).

As part of an ecological study of the Tortugas pink shrimp population, we made a sampling survey of young pink shrimp and associated organisms in central Florida Bay (fig. 1). The incidence of certain plants and animals in the bay may help us detect environments that are suitable for young pink

shrimp. With few exceptions, the plants and animals collected were identified to species and form the list contained in this preliminary report. Except in very general terms, we make no attempt to relate these organisms to the environment. Distribution, abundance, and ecology are left for a later report.

Past ecological studies in Florida Bay include those by Tabb and Manning (1961) and Tabb, Dubrow, and Manning (1962). Their work was confined to the northwestern section of the bay, whereas our report concerns central Florida Bay.

DESCRIPTION OF AREA

Detailed descriptions of the Florida Bay environment were given by Ginsburg (1956) and Gorsline (1963). This shallow bay has an extensive complex of mangrove keys and intersecting mudbanks covered with seagrasses. The network of banks and keys separates the bay into semienclosed basins, locally called "lakes," 40 to 300 cm. deep.

Porpoise Lake, which we selected for study, is a triangular-shaped basin in the east-central portion of the bay (fig. 1). It is bordered on the northwest by the Foxtrot Keys and on the north by Bob Allen Key (fig. 2). The lake has an area of about 10.4 km.² and a maximum depth of 210 cm. Sediments in the lake

and on surrounding banks are mainly carbonate mud mixed with varying amounts of shell fragments and plant detritus. The banks are carpeted with extensive beds of turtle grass, Thalassia testudinum, which extend into the lake but thin rapidly with increasing water depth. The fringe area between the Thalassia and the keys is narrow and covered intermittently with sparse patches of shoal grass, Diplanthera wrightii.

Numerous small channels cut through the enclosing banks to connect Porpoise Lake with surrounding lakes and, finally, the Atlantic Ocean and Gulf of Mexico. The depth of these channels varies from 80 to 245 cm., and they

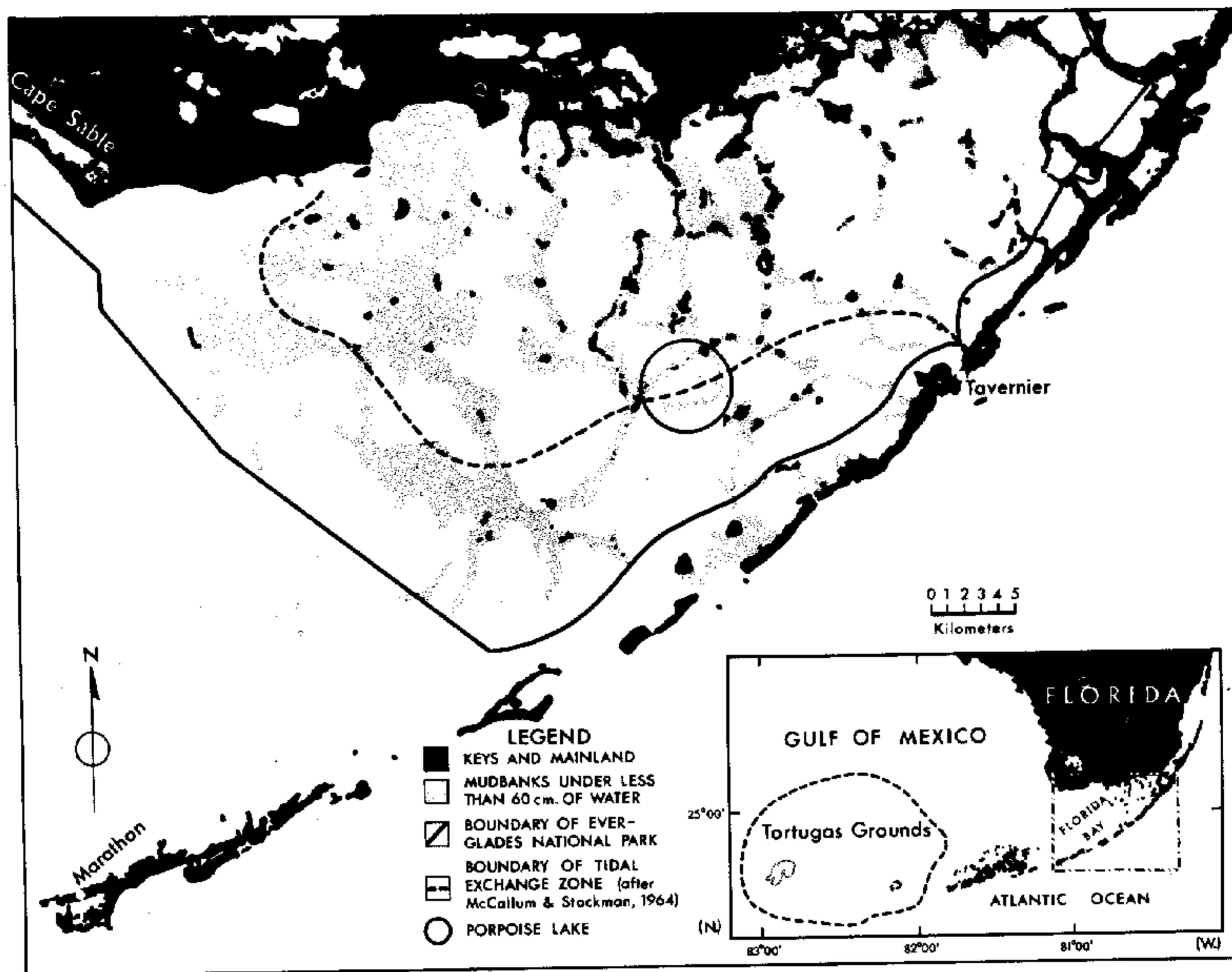


Figure 1.--Location of Porpoise Lake in Florida Bay.

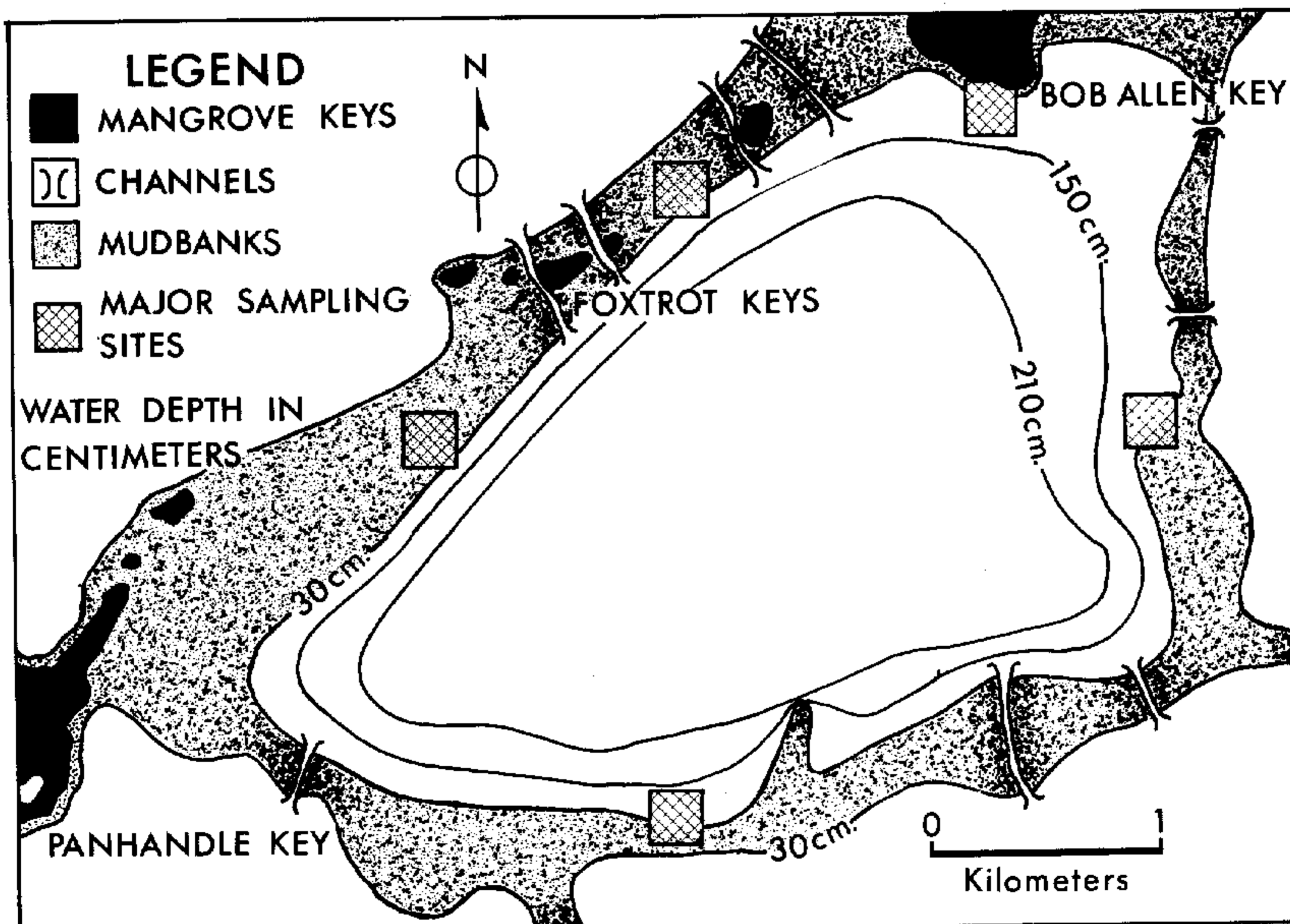


Figure 2.--Porpoise Lake, with surrounding banks and keys.

have an irregular floor of soft carbonate mud, with patches of bedrock exposed by scouring. Moderate to dense stands of Thalassia and Diplanthera cover the mud deltas at each end of the channels and, to some extent, the channels themselves where sediments are sufficiently deep to afford them attachment. Numerous "grass" ledges are formed along the channel banks where undercutting removes the soft sediments, leaving a dense mat of overhanging Thalassia rhizomes.

In addition to passing through the channels, water also is exchanged across the surfaces of the banks, but the dense cover of epiphyte-laden Thalassia restricts this flow and acts as an efficient baffle and filtering system. Although tidal water extends into the lake (McCallum and Stockman, 1964), poor flushing is indicated by abrupt differences in water clarity and salinity between the lake and the ocean water to the south. Strong winds and

seasonal changes in ocean level cause the largest fluctuations in the lake's water level (Ginsburg, 1956). Maximum observed difference in lake level was 38 cm.

We measured salinities and temperatures of the lake water at monthly intervals from November 1964 to January 1968 (table 1). Highest salinity (49.6 p.p.t.) was recorded in July 1965; lowest salinity (27.8 p.p.t.), in September 1966. McCallum and Stockman (1964) reported that in Florida Bay, "...fluctuations in the amount of fresh-water runoff from the mainland produce seasonal and annual fluctuations in salinity." The lack of rainfall in the summer of 1965, and, conversely, the abundance of rainfall in the summer of 1966, were primarily responsible for the difference in the two salinity values. Surface temperature in the lake ranged from 32.2° C. in September 1965 to 16.6° C. in December 1966.

Table 1.--Salinity and temperature of surface waters in Porpoise Lake, November 1964 to January 1968

Month	1964		1965		1966		1967		1968	
	Salinity	Temperature	Salinity	Temperature	Salinity	Temperature	Salinity	Temperature	Salinity	Temperature
	p.p.t.	°C.	p.p.t.	°C.	p.p.t.	°C.	p.p.t.	°C.	p.p.t.	°C.
January	- ¹	-	-	-	39.8	20.5	31.9	22.8	33.7	17.6
February	-	-	-	-	40.0	17.5	29.0	23.2	-	-
March	-	-	40.0	24.9	40.8	19.8	35.2	23.9	-	-
April	-	-	41.3	-	43.1	21.5	37.3	31.6	-	-
May	-	-	45.8	27.3	41.4	27.2	41.7	29.0	-	-
June	-	-	44.3	27.6	36.2	25.0	39.4	31.0	-	-
July	-	-	49.6	31.3	33.1	31.0	39.9	31.5	-	-
August	-	-	46.3	30.2	31.5	30.9	41.3	28.5	-	-
September	-	-	48.6	32.2	27.8	32.0	41.0	29.1	-	-
October	-	-	44.4	27.0	28.7	27.4	35.2	27.2	-	-
November	39.0	24.9	41.3	27.6	29.0	24.3	34.2	27.2	-	-
December	-	24.9	40.3	20.6	30.0	16.6	32.4	26.5	-	-

¹ - = No data

METHODS

From April 1965 to January 1968 we collected samples each month in a *Thalassia* bed adjacent to Bob Allen Key (fig. 2). These samples were taken with a sled-mounted suction sampler (Allen and Hudson)¹ and a slednet.² The suction sampler captures both epifauna and infauna, whereas the slednet captures epifauna only. These devices also were used to sample in *Thalassia* beds on the east, south, and northwest banks of the lake. To supplement the catches made by the suction sampler and slednet, we used a pushnet (Allen and Inglis, 1958), beach seine, and castnet, together with hand collecting.

A bait-shrimp vessel with two roller-frame trawls (Woodburn, Eldred, Clark, Hutton, and Ingle, 1957) was used to sample the lake's biota at night. This method enabled us to investigate more thoroughly the large expanse of lake bottom and capture nocturnal species.

We used face mask and snorkel to examine the channels. The organisms were collected by hand, handnet, and hook and line.

Despite the variety of gear, we did not collect many species known to inhabit the lake. Also, we did not attempt to retain plants and animals less than 5 mm. long or wide.

PORPOISE LAKE SPECIES LIST

<u>Scientific name</u>	<u>Common name</u>
MARINE ALGAE	
Family Dasycladaceae	
<i>Batophora oerstedii</i> var. <i>occidentalis</i> (Harvey) Howe	---
<i>Acetabularia crenulata</i> Lamouroux	Venus wine glass
Family Valoniaceae	
<i>Anadyomene stellata</i> (Wulfen) C. Agardh	---
<i>Cladophoropsis membranacea</i> (C. Agardh) Børgesen	---
<i>Cladophoropsis macromeres</i> Taylor	---
Family Caulerpaceae	
<i>Caulerpa paspaloides</i> var. <i>wurdemanni</i> Weber-van Bosse	---
<i>Caulerpa lanuginosa</i> J. Agardh	---
<i>Caulerpa cupressoides</i> var. <i>cupressoides</i> (West) C. Agardh	---
<i>Caulerpa sertularioides</i> (Gmelin) Howe	---
Family Codiaceae	
<i>Penicillus capitatus</i> Lamarck	---
<i>Penicillus dumetosus</i> (Lamouroux) Blainville	---
<i>Rhipocephalus phoenix</i> (Ellis and Solander) Kützting	---
<i>Udotea spinulosa</i> Howe	---
<i>Halimeda incrassata</i> (Ellis) Lamouroux	---
Family Gracilariaceae	
<i>Gracilaria</i> sp.	---
Family Ceramiaceae	
<i>Spyridia filamentosa</i> (Wulfen) Harvey	---
<i>Ceramium rubrum</i> (Hudson) C. Agardh	---
Family Rhodomelaceae	
<i>Laurencia poitei</i> (Lamouroux) Howe	---
<i>Digenia simplex</i> (Wulfen) C. Agardh	---

¹ Donald M. Allen and J. Harold Hudson, 1969. A sled-mounted suction sampler for benthic organisms. Unpublished manuscript, 13 pp., filed at the Bureau of Commercial Fisheries Tropical Atlantic Biological Laboratory, Miami, Fla. 33149.

² A hand-pulled frame trawl, similar to that described by Pullen, Mock, and Ringo (1968).

SEA GRASSES

Family Hydrocharitaceae

Thalassia testudinum König

Turtle grass

Family Zosteraceae

Diplanthera wrightii (Ascherson) Ascherson

Shoal grass

Syringodium filiforme Kützting

Manatee grass

SPONGES

Family Chondrillidae

Chondrilla nucula Schmidt

Chickenliver sponge

Family Dysideidae

Dysidea fragilis (Montagu) Johnson

COELENTERATES

Family Rhizophysaliidae

Physalia physalis Linnaeus

Portuguese man-of-war

Family Chondrophoridae

Velella velella Linnaeus

By-the-wind sailor

Family Poritidae

Porites porites var. furcata Lamarck

Finger coral

Family Faviidae

Solenastrea hyades (Dana)

Knobby star coral

BRYOZOANS

Family Schizoporellidae

Schizoporella sp.

ANNELIDS

Family Polynoidae

Harmothoe aculeata Andrews

Family Hesionidae

Hesione picta Müller

Family Nereidae

Ceratonereis mirabilis Kinberg

Family Glyceridae

Glycera sp.

Family Dorvilleidae

Dorvillea rudolphii (delle Chiaje)

Family Spionidae

Prionospio heterobranchia Moore

<u>Armandia maculata</u> (Webster)	Family Opheliidae	Javelin worm
MOLLUSKS		
	Family Fissurellidae	
<u>Diodora cayenensis</u> Lamarck		Cayenne keyhole limpet
	Family Trochidae	
<u>Calliostoma jujubinum tampaense</u> Conrad		Jujube top-shell
<u>Tegula fasciata</u> Born		Smooth Atlantic tegula
	Family Turbinidae	
<u>Turbo castaneus</u> Gmelin		Chestnut turban
<u>Astraea phoebia</u> Röding		Long-spined star-shell
<u>Astraea tecta americana</u> Gmelin		American star-shell
	Family Modulidae	
<u>Modulus modulus</u> Linnaeus		Atlantic modulus
	Family Potamididae	
<u>Batillaria minima</u> Gmelin		False cerith
	Family Cerithidae	
<u>Cerithium muscarum</u> Say		Fly-specked cerith
	Family Calyptraeidae	
<u>Crepidula convexa</u> Say		Convex slipper-shell
<u>Crepidula plana</u> Say		Eastern white slipper-shell
	Family Muricidae	
<u>Murex cellulosus</u> Conrad		Pitted murex
<u>Muricopsis ostrearum</u> Conrad		Mauve-mouth drill
<u>Eupleura sulcidentata</u> Dall		Sharp-ribbed drill
	Family Columbelloidae	
<u>Columbella rusticoidea</u> Heilprin		Rusty dove-shell
	Family Melongenidae	
<u>Melongena corona</u> Gmelin		Common crown conch
<u>Busycon contrarium</u> Conrad		Lightning whelk
<u>Busycon spiratum</u> Lamarck		Pear whelk
	Family Nassariidae	
<u>Nassarius vibex</u> Say		Common eastern nassa
<u>Nassarius albus</u> Say		Variable nassa
	Family Fasciolaridae	
<u>Fasciolaria tulipa</u> Linnaeus		True tulip
<u>Fasciolaria hunteria</u> Perry		Banded tulip
	Family Olividae	
<u>Olivella minuta</u> Link		Minute dwarf olive
	Family Marginellidae	
<u>Prunum apicinum</u> Menke		Common Atlantic marginella

<u>Conus stearnsi</u> Conrad	Family Conidae	Stearn's cone
<u>Cerodrillia thea</u> Dall	Family Turridae	Thea drillia
<u>Bulla striata</u> Bruguière	Family Bullidae	Striate bubble
<u>Haminoea antillarum</u> Orbigny	Family Atyidae	Antillean paper-bubble
<u>Ischnochiton papillosus</u> C. B. Adams	Family Ischnochitonidae	Mesh-pitted chiton
<u>Arcopsis adamsi</u> E. A. Smith	Family Arcidae	Adams' miniature ark
<u>Brachidontes exustus</u> Linnaeus	Family Mytilidae	Scorched mussel
<u>Pinctada radiata</u> Leach	Family Pteriidae	Atlantic pearl oyster
<u>Argopecten irradians concentricus</u> (Say)	Family Pectinidae	Atlantic bay scallop
<u>Lima pellucida</u> C. B. Adams	Family Limidae	Antillean lima
<u>Cardita floridana</u> Conrad	Family Carditidae	Broad-ribbed cardita
<u>Codakia orbiculata</u> Montagu	Family Lucinidae	Dwarf tiger lucina
<u>Laevicardium mortoni</u> Conrad	Family Cardiidae	Morton's egg cockle
<u>Chione cancellata</u> Linnaeus	Family Veneridae	Cross-barred venus
<u>Anomalocardia cuneimeris</u> Conrad		Pointed venus
<u>Transennella cubaniana</u> Orbigny		Cuban transennella
<u>Transennella stimpsoni</u> Dall		Stimpson's transennella
<u>Tellina tampaensis</u> Conrad	Family Tellinidae	Tampa tellin
<u>Tellina similis</u> Sowerby		Candy stick tellin
<u>Tellina lineata</u> Turton		Rose petal tellin
<u>Lyonsia hyalina floridana</u> Conrad	Family Lyonsiidae	Glassy lyonsia
<u>Octopus joubini</u> Robson	Family Octopodidae	Joubin's octopus

HORSESHOE CRABS

Family Limulidae

Limulus polyphemus Linnaeus

Horseshoe crab

PYCNOGONIDS

Family Phoxichilidiidae

Anoplodactylus insignis (Hoek)

Anoplodactylus lentus Wilson

Anoplodactylus pectinus Hedgpeth

Family Ammotheidae

Nymphopsis duodorsospinosa Hilton

CRUSTACEANS

Family Balanidae

Balanus amphitrite niveus Darwin

Family Anthuridae

Cyathura polita (Stimpson)

Family Cirolanidae

Cirolana parva Hansen

Family Aegidae

Rocinela signata Schioedte and Meinert

Family Sphaeromidae

Paracerceis caudata (Say)

Cymodoce faxoni (Richardson)

Sphaeroma destructor Richardson

Putty bug

Family Idotheidae

Cleantis planicauda Benedict

Erichsonella floridana Benedict

Family Penaeidae

Penaeus duorarum duorarum Burkenroad

Pink shrimp

Family Palaemonidae

Leander paulensis Ortmann

Leander tenuicornis (Say)

Periclimenes americanus (Kingsley)

Periclimenes longicaudatus (Stimpson)

Family Alpheidae

Alpheus heterochaelis Say

Big-clawed snapping shrimp

Alpheus normanni Kingsley

Green snapping shrimp

Family Hippolytidae

Hippolyte pleuracantha (Stimpson)

Latreutes fucorum (Fabricius)

Thor sp.

Tozeuma carolinense Kingsley

Bayonet shrimp

Family Processidae

Processa sp.

Family Palinuridae

Panulirus argus (Latreille)

Spiny lobster

Family Paguridae

Pagurus bonairensis Schmitt

Family Diogenidae

Paguristes tortugae Schmitt
Petrochirus diogenes (Linnaeus)

Family Dromiidae

Dromidia antillensis Stimpson

Family Calappidae

Calappa sp.

Family Portunidae

Callinectes sapidus Rathbun
Callinectes ornatus Ordway
Portunus depressifrons (Stimpson)
Cronius ruber (Lamarck)

Blue crab

Family Xanthidae

Menippe mercenaria (Say)
Neopanope packardii (Kingsley)

Stone crab

Family Majidae

Libinia dubia H. Milne Edwards
Mithrax spinosissimus (Lamarck)
Pitho anisodon (von Martens)

ECHINODERMS

Family Echinasteridae

Echinaster sentus (Say)

Family Amphiuridae

Amphioplus abditus (Verrill)
Amphiodia pulchella (Lyman)

Family Ophiactidae

Ophiactis savignyi (Müller and Troschel)

Family Ophiotrichidae

Ophiothrix örstedii Lütken

Family Holothuriidae

Holothuria floridana Pourtalès

Family Diadematidae

Diadema antillarum (Philippi)

Long-spined sea urchin

CHAE TOGNATHS

Family Sagittidae

Sagitta hispida Conant

Arrowworm

FISHES

Family Orectolobidae

Ginglymostoma cirratum (Bonnaterre)

Nurse shark

Family Carcharhinidae

Negaprion brevirostris (Poey)

Lemon shark

Family Sphyrnidae

Sphyrna tiburo (Linnaeus)

Bonnethead shark

Family Pristidae

Pristis pectinatus Latham

Smalltooth sawfish

Family Dasyatidae

Dasyatis americana Hildebrand and Schroeder

Southern stingray

Family Elopidae

Elops saurus Linnaeus

Ladyfish

Megalops atlantica Valenciennes

Tarpon

Family Albulidae

Albula vulpes (Linnaeus)

Bonefish

Family Clupeidae

Harengula pensacolata Goode and Bean

Scaled sardine

Opisthonema oglinum (LeSueur)

Atlantic thread herring

Family Engraulidae

Anchoa mitchilli (Valenciennes)

Bay anchovy

Anchoa lamprotaenia Hildebrand

Longnose anchovy

Family Synodontidae

Synodus foetens (Linnaeus)

Inshore lizardfish

Family Ariidae

Galeichthys felis (Linnaeus)

Sea catfish

Family Belonidae

Strongylura notata (Poey)

Redfin needlefish

Family Hemiramphidae

Chriodorus atherinoides Goode and Bean

Hardhead halfbeak

Hyporhamphus unifasciatus (Ranzani)

Halfbeak

Family Cyprinodontidae

Cyprinodon variegatus Lacépède

Sheepshead minnow

Lucania parva (Baird and Girard)

Rainwater killifish

Family Poeciliidae

Poecilia latipinna (LeSueur)

Sailfin molly

Family Syngnathidae

Hippocampus zosterae Jordan and Gilbert
Syngnathus floridae (Jordan and Gilbert)
Syngnathus scovelli (Evermann and Kendall)
Micrognathus crinigerus (Bean and Dresel)

Dwarf seahorse
 Dusky pipefish
 Gulf pipefish
 Fringed pipefish

Family Centropomidae

Centropomus undecimalis (Bloch)

Snook

Family Serranidae

Epinephelus itajara (Lichtenstein)
Mycteroperca microlepis (Goode and Bean)

Jewfish
 Gag

Family Lutjanidae

Lutjanus griseus (Linnaeus)
Lutjanus synagris (Linnaeus)
Lutjanus apodus (Walbaum)

Gray snapper
 Lane snapper
 Schoolmaster

Family Rachycentridae

Rachycentron canadum (Linnaeus)

Cobia

Family Carangidae

Caranx crysos (Mitchill)
Caranx hippos (Linnaeus)
Oligoplites saurus (Bloch and Schneider)

Blue runner
 Crevalle jack
 Leatherjacket

Family Gerridae

Eucinostomus argenteus Baird and Girard
Eucinostomus gula (Quoy and Gaimard)

Spotfin mojarra
 Silver jenny

Family Pomadasyidae

Haemulon sciurus (Shaw)
Orthopristis chrysopterus (Linnaeus)

Bluestriped grunt
 Pigfish

Family Sciaenidae

Cynoscion nebulosus (Cuvier)
Sciaenops ocellata (Linnaeus)

Spotted seatrout
 Red drum

Family Sparidae

Archosargus probatocephalus (Walbaum)
Lagodon rhomboides (Linnaeus)

Sheepshead
 Pinfish

Family Ephippidae

Chaetodipterus faber (Broussonet)

Atlantic spadefish

Family Pomacentridae

Abudefduf saxatilis (Linnaeus)

Sergeant major

Family Labridae

Halichoeres bivittatus (Bloch)

Slippery dick

Family Gobiidae

Gobiosoma robustum Ginsburg
Microgobius microlepis Longley and Hildebrand
Microgobius gulosus (Girard)

Code goby
 Banner goby
 Clown goby

Family Triglidae

Prionotus pectoralis (Nichols and Breder)

Blackwing searobin

Family Clinidae

Chaenopsis ocellata Poey
Paraclinus marmoratus (Steindachner)

Bluethroat pikeblenny
Marbled blenny

Family Blenniidae

Blennius marmoreus Poey

Seaweed blenny

Family Sphyraenidae

Sphyraena barracuda (Walbaum)

Great barracuda

Family Mugilidae

Mugil curema Valenciennes
Mugil cephalus Linnaeus

White mullet
Striped mullet

Family Atherinidae

Membras martinica (Valenciennes)
Allanetta harringtonensis (Goode)

Rough silverside
Reef silverside

Family Soleidae

Achirus lineatus (Linnaeus)

Lined sole

Family Gobiesocidae

Gobiesox strumosus Cope

Skilletfish

Family Ostraciidae

Acanthostracion quadricornis (Linnaeus)

Cowfish

Family Tetraodontidae

Sphaeroides nephelus (Goode and Bean)

Southern puffer

Family Diodontidae

Chilomycterus schoepfi (Walbaum)

Striped burrfish

Family Batrachoididae

Opsanus beta (Goode and Bean)

Gulf toadfish

Family Callionymidae

Callionymus pauciradiatus Gill

Spotted dragonet

MARINE MAMMALS

Family Delphinidae

Tursiops truncatus Montague

Bottlenose dolphin

ECOLOGICAL CONSIDERATIONS

Our survey revealed 169 genera and 196 species of plants and animals in Porpoise Lake. Benthic forms made up 73 percent of the animals listed, and many of them are well-known associates of the seagrass community. The importance of seagrass beds as habitats for small marine animals has been stressed by Phillips (1960), Moore (1963), and Hoese and Jones (1963), among others. We found that young pink shrimp and many small benthic animals (annelids, mollusks, crustaceans, and fishes)

were present throughout the year in shallow Thalassia beds bordering the lake. Species not usually found in these seagrass beds inhabited the channels transecting the banks of the lake. These species included the knobby star coral (Solenastrea hyades), the long-spined sea urchin (Diadema antillarum), the spiny lobster (Panulirus argus), and the schoolmaster (Lutjanus apodus). Although these species are common on the Atlantic side of the Florida Keys (Springer and McErlean, 1962; Turmel and

Swanson, 1964; Kissling, 1965), they are rare or absent in the channels of northwestern Florida Bay (Tabb and Manning, 1961).

Within the seagrass areas of Porpoise Lake that are superficially homogeneous, several animals had discontinuous distribution. The finger coral (*Porites porites* var. *furcata*), the American star-shell (*Astraea tecta americana*), and the long-spined star-shell (*A. phoebia*), were along the southern bank but not the northern bank of this basin. We did not see these species in central Florida Bay north of Porpoise Lake, nor did Tabb and Manning (1961) report them from northwestern Florida Bay. These species are common, however, on the Atlantic side of the Florida Keys (Voss and Voss, 1955; Kissling, 1965).

Ginsburg (1956) observed that organisms which inhabit the reef tract³ paralleling the Atlantic side of the Florida Keys may be abundant in the outer or marginal zone of Florida Bay where there is tidal exchange with the reef tract and where salinities are near "normal." Furthermore, Turney (1964) found the distribution of mollusks in Florida Bay to be related primarily to water circulation, and

he cited *A. americana* (*A. tecta americana*) as a characteristic species of the Atlantic margin of Florida Bay, an area of frequent exchange of water with the Atlantic Ocean. This tidal water extends into the southern portion of Porpoise Lake (McCallum and Stockman, 1964) and meets the slowly circulating waters of the inner bay which have fluctuating salinities and temperatures (Gorsline, 1963).

Different masses of water have dissimilar ecological effects and support distinctive populations of organisms (Phleger, 1964; Cerame-Vivas and Gray, 1966). Water movements in Florida Bay produce separate water masses that have unlike characteristics (Gorsline, 1963). Within Porpoise Lake, animal associates of the seagrass beds differ from those of the adjacent channels. These abrupt variations in fauna suggest the effects of extremely local habitats that cannot, necessarily, be attributed to different water masses. The general distribution of organisms in the lake and in Florida Bay, however, defines varied environments created or influenced by different water masses.

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LITERATURE CITED

- ALLEN, DONALD M., and ANTHONY INGLIS.
1958. A pushnet for quantitative sampling of shrimp in shallow estuaries. *Limnol. Oceanogr.* 3: 239-241.
- CERAME-VIVAS, M. J., and I. E. GRAY.
1966. The distributional pattern of benthic invertebrates of the continental shelf off North Carolina. *Ecology* 47: 260-270.
- COSTELLO, T. J., and DONALD M. ALLEN.
1966. Migrations and geographic distribution of pink shrimp, *Penaeus duorarum*, of the Tortugas and Sanibel grounds, Florida. U.S. Fish Wildl. Serv., Fish. Bull. 65: 449-459.
- GINSBURG, ROBERT N.
1956. Environmental relationships of grain size and constituent particles in some south Florida carbonate sediments. *Bull. Amer. Ass. Petrol. Geol.* 40: 2384-2427.
- GORSLINE, DONN S.
1963. Environments of carbonate deposition Florida Bay and the Florida Straits. In *Shelf carbonates of the Paradox Basin*, pp. 130-143. Four Corners Geol. Soc., Fourth Field Conf. Symp.
- HOESE, H. D., and R. S. JONES.
1963. Seasonality of larger animals in a Texas turtle grass community. *Publ. Inst. Mar. Sci. Univ. Tex.* 9: 37-47.
- KISSLING, DON L.
1965. Coral distribution on a shoal in Spanish Harbor, Florida Keys. *Bull. Mar. Sci.* 15: 599-611.
- MCCALLUM, J. S., and K. W. STOCKMAN.
1964. Water circulation. In R. N. Ginsburg (editor), *South Florida carbonate sediments*, Guidebook Field Trip No. 1, pp. 11-13. Geol. Soc. Amer. Annu. Conv.
- MOORE, DONALD R.
1963. Distribution of the sea grass, *Thalassia*, in the United States. *Bull. Mar. Sci. Gulf Carib.* 13: 329-342.
- ³ Ginsburg defined the reef tract as "the arcuate band-shaped area east, southeast, and south of the Keys between 0 and 300 feet."

PHILLIPS, RONALD C.

1960. Observations on the ecology and distribution of the Florida seagrasses. Fla. State Bd. Conserv. Mar. Lab. Prof. Pap. Ser. 2, 72 pp.

PHLEGER, FRED B.

1964. Foraminiferal ecology and marine geology. Mar. Geol. 1: 16-43.

PULLEN, E. J., C. R. MOCK, and R. D. RINGO.

1968. A net for sampling the intertidal zone of an estuary. Limnol. Oceanogr. 13: 200-202.

SPRINGER, VICTOR G., and ANDREW J. McERLEAN.

1962. Seasonality of fishes on a south Florida shore. Bull. Mar. Sci. Gulf Carib. 12: 39-60.

TABB, DURBIN C., DAVID L. DUBROW, and RAYMOND B. MANNING.

1962. The ecology of northern Florida Bay and adjacent estuaries. Fla. State Bd. Conserv. Tech. Ser. 39, 81 pp.

TABB, DURBIN C., and RAYMOND B. MANNING.

1961. A checklist of the flora and fauna of northern Florida Bay and adjacent brackish waters of the Florida mainland collected during the period July 1957

through September 1960. Bull. Mar. Sci. Gulf Carib. 11: 552-649.

TURMEL, REAL, and ROGER SWANSON.

1964. Rodriguez Bank. In R. N. Ginsburg (editor), South Florida carbonate sediments, Guidebook Field Trip No. 1, pp. 26-33. Geol. Soc. Amer. Annu. Conv.

TURNER, W. J.

1964. Molluscan fauna. In R. N. Ginsburg (editor), South Florida carbonate sediments, Guidebook Field Trip. No. 1, pp. 14-16. Geol. Soc. Amer. Annu. Conv.

VOSS, GILBERT L., and NANCY A. VOSS.

1955. An ecological survey of Soldier Key, Biscayne Bay, Florida. Bull. Mar. Sci. Gulf Carib. 5: 203-229.

WOODBURN, KENNETH D., BONNIE ELDRED, EUGENIE CLARK, ROBERT F. HUTTON, and ROBERT M. INGLE.

1957. The live bait shrimp industry of the west coast of Florida (Cedar Key to Naples). Fla. State Bd. Conserv. Tech. Ser. 21, 33 pp.

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